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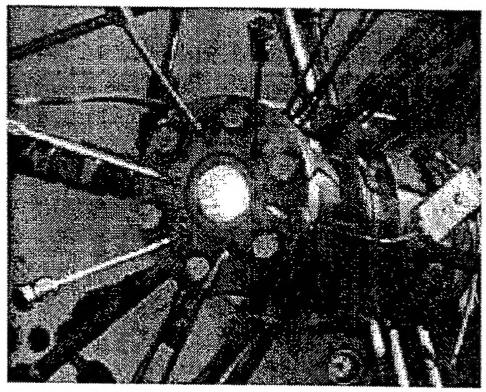
(Statement A)

» Advanced Propulsion Development Engine Nails First-Round Testing

By Susie Unkeless

As part of the Advanced Lightweight Chamber and Nozzle (ALCAN) program, over 50 hot fire tests were run in the Mojave desert over a wide range of pressures and mixture ratios in February and March. These proof-of-concept engines are designed to perhaps one day produce a booster-sized engine weighing half as much as the SSME, with increased performance.


This transpiration cooled ceramic thrust chamber underwent a series of successful tests at the Mojave (Calif.) Test Area during Feburary and March. As part of the Advanced Lightweight Chamber and Nozzle (ALCAN) program, over 50 hot fire tests were run over a wide range of chamber pressures and mixture ratios.

The first round of tests, conducted at Polaris Propulsion's Mojave Test Area, were intended to prove the viability of the concept, according to Rocketdyne's Program Manager Scott Claflin. "In other words, we were trying to prove that we could efficiently operate a combustion chamber with a transpiration cooled ceramic matrix composite (CMC) liner."

Transpiration, a cooling technique in which a very small percentage of the rocket fuel flow is introduced through uniformly distributed pores in the combustion chamber wall, is similar to what happens when humans perspire.

"In layman's terms, the combustion chamber wall 'sweats'" explained Claflin. "The coolant carries away heat from the wall then vaporizes (or evaporates) to absorb heat from the surrounding environment forming a relatively cool environment near the chamber wall."

Throughout the course of the tests, Claflin's team from Canoga Park, Kevin Lohner, Jeff Stout, Gerard Pelletier, Doug Ades, Jim Beck, Arun Battacharya, Dan Wisner, Brad Hemmings, Maria Corral, Amar Litt and Ed Bechtel from Boeing Canoga Park, had to overcome many obstacles.

"The tests taught us that we could operate a CMC liner at temperatures greater than 3,000 degrees Fahrenheit," he explained. "We learned that we could fabricate CMC liners with appropriately porosity (or permeability) to allow efficient transpiration cooling with either hydrogen or methane. More importantly, we learned that our recently-developed analysis tools accurately predict transpiration cooling effectiveness."

But the team also had to overcome something bigger – designing and fabricating something that has never been made before. Because this technology is so new, Claflin and his team are continuing to push the envelope to prove the viability of their efforts.

"Now we have to demonstrate that CMC liners can meet rocket life requirements and that we can fabricate a CMC liner with tailored permeability and at the same time reduce the time and cost of producing large CMC components."

The ALCAN program schedule, which is strongly driven by funding availability and currently funded and directed by the Air Force Research Laboratory, has Canoga Park building new hot-fire parts this year and testing them early in 2004. If the 60 Klb thrust test series is successful, explained Claflin, they would be ready to begin full-scale development.

"I think the technology could be ready for use on a booster engine in five years," Claflin said optimistically.

Next up for Claflin and his team, more tests but not with the small proof-of-concept hardware. They will now

scale the technology to higher thrust levels.

(April 24, 2003)

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